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MEMORANDUM FOR: Mr. Dulles

Pete Scoville advises that this is a sanitized version of our Top Secret report on this subject which, according to Pete, you have already seen. The other four copies received from [redacted] have been forwarded to Pete.

STAT

[redacted] ILLEGIB

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22 January 60

(DATE)

FORM NO. 101 REPLACES FORM 10-101
1 AUG 54 WHICH MAY BE USED. (47)

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Frank declassified this
Both KP & WR think it can be released.

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A COMPARISON OF US AND USSR CAPABILITIES IN SPACE

Unclassified

I. INTRODUCTION

During the era of space activity which began with the launching of Sputnik I on 4 October 1957, the Soviets have exploited their achievements in space missions skillfully and deliberately for purposes of political propaganda. This campaign has been very effective in demonstrating to the world the rapid technological advancement of the USSR. This campaign has also raised serious doubts throughout the world concerning the technological supremacy (and hence - so the argument runs - military superiority) of the United States.

Unclassified

A study has been made, therefore, to examine soberly and in detail the relative present capabilities of the U.S. and the USSR in those fields of endeavor that bear on their activities in space, and to project these comparisons at least a short way into the future. In the course of this study, the ICBM program itself was not considered, except insofar as it related to the issue of space.

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II. CONCLUSIONS

The major conclusions that have emerged from this comperative study are for convenience listed at this point. The remainder of the text constitutes a brief amplification and documentation of these conclusions.

Unclassified

General Conclusion

1. It is concluded that from an over-all viewpoint the U.S. is behind the USSR in total space achievements. All present indications suggest that this situation will persist for some years to come.

Unclassified

Underlying Factors and Dissymmetries

2. Because of the difference in concept between the U.S. and USSR ICBM programs, that provided the latter with large boosters, the USSR has a lead of several years over the U.S. in the development of reliable space vehicles having a large weight-lifting capacity. This "vehicle lag" puts some very telling advantages in Soviet hands.

   a) This payload advantage permits the USSR the exclusive capability to perform certain missions.

   b) Large payload capability tends to offset some of the advantages that would accrue to the U.S. from its apparent superiority in the miniaturization and packaging of electronic and experimental equipment.

   c) A lack of critical restrictions on payload size and weight permits the Soviets a shorter lead time than

the U.S. between conception and execution of any given space experiment. This opens the door to Russian preemptive tactics in the face of anticipated or announced U.S. missions.

d) A greater weight-lifting capability can contribute significantly to overall reliability, in vehicles especially, by permitting more conservative design.

Unclassified

3. In the U.S. programs to date the vehicle lag has been aggravated by the unavailability of its ICBM's as boosters, a situation which should shortly be remedied. However, at the present level of U.S. effort, a substantial vehicle lag may well persist for a number of years, if not indefinitely. Increased priority and funds could increase the rate at which the gap is closed, but there is no conceivable way in which an immediate closure could be made.

Unclassified

4. The Russians also continue to profit from having had a lead of at least four years over the U.S. in officially organizing and planning for a systematic national space program. This fact, coupled with the early availability of large boosters, has apparently permitted the Soviet space program to proceed with greater clarity and practical understanding of relative priorities and national objectives than obtains in the U.S.

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Unclassified 5. The U.S. has major advantages, both technical and political, in its present and projected global tracking and communication network:

a) The continuity in tracking and monitoring, that such a network makes possible, greatly extends the scope and quality of the operations that can be accomplished effectively.

b) The network can also be utilized to enhance the benefits that can be derived from international participation in and identification with U.S. space programs.

Unclassified 6. The U.S. and the USSR stand in approximately equivalent natural positions with respect to interest in deep space probes and scientific space exploration generally. However, the U.S. has a particularly strong interest in the exploitation of near space for such "service purposes" as reconnaissance, early warning, communication, navigation, meteorology, etc. This interest stems in part from the importance of such functions in the general U.S. military position and in part from the applicability of many of them to our normal civilian interests. The U.S. deficiency in weight lifting capabilities in the next several years is not quite as serious in these areas as it is in most areas of space endeavor.

Unclassified 7. The USSR has not discussed the use of any space system for military use, whether as a weapon carrier or as a support system. The U.S. is developing such support

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systems since it presumably has greater military need than the USSR, in such uses as communications, early warning, etc. However, the Soviets no doubt possess a clear understanding of the potentials in the support fields, and Russian technology has adequate strength to develop support systems if they should be desired.

Unclassified 8. The U.S. has launched a wider variety of satellites and space probes than the USSR. These include a number intended primarily to explore "service" functions such as meteorology and communications.

Unclassified 9. Neither nation is handicapped in the prosecution of its space effort by any critical gaps in its basic technologies, including such important areas as guidance, instrumentation, etc. The U.S. has a slight lead in many relevant areas of technology, and this lead has been very helpful in the last 2 years. However, there are disquieting indications that in certain areas, at least, the rate of technological progress in the USSR may exceed that in the U.S.

Results to Date

Unclassified 10. The purely scientific return from the U.S. space program is somewhat superior to that of the USSR. The U.S. has excelled in the scientific exploits of a more scholarly character, the USSR in those of a somewhat more spectacular character.

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Unclassified 11. The USSR space program, while it has yielded sound scientific results, has also had far greater popular appeal than that of the U.S. This fact has already resulted in telling political advantages for the Soviet Union, and may be reflected in corresponding economic and cultural advantages stemming from their increased technological stature. It would be dangerous for the U.S. to dismiss as trivial those aspects of space activity which possess such popular appeal. However, a vehicle capability comparable with that of the USSR will be required before the U.S. can hope to compete in this respect.

Unclassified 12. The USSR has the scientific and other resources necessary to pursue a highly ambitious program for the scientific uses of space. Thus, unless our scientific program continues to be pursued vigorously, the USSR could surpass us in this field also.

Unclassified 13. The U.S. has been far more conscientious than the USSR in the prompt and full dissemination of its scientific space data. This fact has increased U.S. national prestige in the world scientific community, and, although not so widely known as it should be, reflects an important constituent in our international position with respect to space.

Special Aspects of U.S. and USSR Space Programs

Unclassified 14. Compared with what can be deduced from an examination of

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the Soviet space program , the conduct of the U.S. program appears to suffer from several generic defects:

a) Inadequate component testing and payload testing prior to actual flight.

b) Lack of sufficient hardware to permit prompt back-up flights.

Particular Objectives and Missions

Unclassified 15. There is much evidence to suggest a strong Soviet interest in the manned exploration of space. Recovery of man from orbit "at an early date" is a stated Russian objective. Extensive Soviet bio-medical space experimentation, and the quality of Soviet engineering, make this objective a feasible one. The greater USSR payload capability will give them a continuing advantage with respect to manned flights, an advantage, however, which may be partially offset by the apparently greater U.S. experience in high velocity recovery techniques.

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Unclassified 16. The U.S. has taken important initiatives to promote international cooperation in space activities. This fact and the contrast in this respect between the U.S. and the USSR, have gained some recognition among other countries for this U.S. objective. The greater U.S. emphasis, as compared to the USSR, on the development of civilian science satellites for such functions as communications and meteorology may continue to enhance the U.S. position in this respect.

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III. A BRIEF HISTORY OF SPACE-ORIENTED ACTIVITY IN THE US AND THE USSR

Unclassified

Prior to World War II, both the U.S. and the USSR were the scene of essentially amateur interest in rocketry. This interest was better organized in the USSR than here, and resulted in 1929 in an organization known as GIRD ("group studying reactive motion"), which from 1934 on enjoyed government support. This group enlisted the cooperation of such pioneers as Pobedonostsev and Tikhonravov, and engaged in programs of design, test and vertical firing. The U.S. work was largely pioneered by Goddard, who first developed the liquid rocket. U.S. efforts received no substantial government support until 1942, under the impetus of the war.

Unclassified

The really fateful days of history, that largely determined the subsequent course of events began at the close of World War II. Both nations started with some native competence in rocketry and with captured teams of German rocket scientists and a stock of V-2 missiles. Both nations absorbed the large-rocket technology so offered them, and both studied its application to ballistic missiles - in particular to the ICBM. Indeed, the early Atlas designs bore a marked similarity insofar as their capabilities were concerned -- thrusts of three-quarters of a million pounds, and gross weights of a half million pounds -- to those which the USSR is currently using in both its military and space applications.

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Confidential During the last half of the 1940's and the early 1950's, however, the two countries took different roads. The U.S. took the road of the manned bomber and the aerodynamic unmanned missiles, while the Soviets took that of the ballistic missile, with the manned bomber as backup.

Unclassified Consequently, U.S. work on the ICBM proceeded at very low priority until 1954, while by 1952 the Russians are known to have possessed a tested set of components (except for the combustion chamber) for a 100 metric ton (220,000 lbs.) motor, on which an ICBM capability could have been based.

Unclassified A second determinant was simultaneously at work. The U.S. had produced its first atomic explosion in 1945, the Russians theirs in 1949. Their first thermonuclear events (1953-55) lagged our own (1952-53) by about one to three years. These events had considerable influence on the sizing the two countries adopted for their ICBM -- and hence for their space -- vehicles. We made our decision in 1954 when a relatively light warhead was felt to be sufficient.

If, as seems likely, the USSR made its decision prior to 1953 (and with no great fund of practical thermonuclear experience), a heavier allowance for nose cone weight would have been quite natural.

Unclassified By 1953, the Soviet interest in space exploration was well-developed, and by 1954 this interest had become explicit

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and official. It is impossible to say that this interest influenced the decision on vehicle size; it is certain, however, that the two considerations pulled in the same direction. By 1954, at the time of the U.S. decision, there was not yet a fully-formulated national interst in space. Even had there been such interest, it could not have been allowed to interfere, at that late date, with what was certainly the militarily correct response to an imminent threat.

Unclassified

The decisions discussed above were the direct determinants of the present payload disparity that is so distressingly evident between U.S. and USSR space operations.

Unclassified

It has been pointed out that an official Soviet interest in space dates back at least as far as 1953. This interest crystallized dramatically in late 1954 with the creation, under the USSR Academy of Sciences, of the ICIC (Interagency Commission for Interplanetary Communications), with the directive to coordinate and direct all work concerned with solving the problem of mastering cosmic space. This powerful body appears to be executive rather than advisory, and it has apparently worked out a satisfactory modus vivendi with the military, on whose vehicles and facilities its operations depend. The Russian objectives in the long-range pursuit of their space program, as gleaned from statements of her scientists and statesmen, are varied; but the central theme that runs through them all is "manned exploration of space." The very considerable amount of bio-medical effort that has characterized the Soviet

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space program lends credibility to this theme.

Unclassified — The U.S. event in any way comparable with the formation of the ICIC did not take place until 1958, with the Space Act and the establishment of the NASA, and the subsequent evolution of the NASA/AF/ARPA managerial complex.

Unclassified — The USSR, like the U.S., stresses the "peaceful" uses of space, and indeed this theme has assumed a dominant place in its propaganda. The Russians have accordingly been very cautious in their direct remarks about the military potential of space. However, common sense and the few veiled references that have been made make it difficult to believe that possible military applications have been absent from their thinking. Difference in national requirements dictated by corresponding differences in geography, freedom of the press and ease of travel, make such applications (navigation, communications, etc satellites) or more interest to ourselves than to them.

Unclassified — The four year gap between the ICIC of 1954 and the Space Act of 1958 is probably a minimum measure of the lag of the U.S. behind the USSR in the matter of a serious interest in and planning for the space age.

Unclassified — In 1955 the U.S. announced its intention, in connection with its activities for the International Geophysical Year, to place a scientific satellite into orbit around the earth. The USSR did not announce a similar intention until 1956. The Vanguard program was officially established to implement the U.S. intent. This program, together with the Army-Navy

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Orbiter nose-cone program, gave the U.S. some momentum in vehicle development and scientific thought and planning with which to enter the period of space activity.

Unclassified

The key date of the space age is 4 October 1957, when the USSR put its Sputnik I in orbit, with a payload of 184 lbs. The corresponding U.S. event was the successful launching on 31 January 1958, of the Explorer I with a payload of 18 lbs.

Unclassified

The period following the Russian launching brought into focus an objective of the USSR that has since been painfully evident -- the intent to exploit and direct their space program to maximum political advantage. While it can hardly be doubted that the Soviets foresaw the political utility of Sputnik I, it is perhaps permissible to question whether they truly anticipated the magnitude of the world-wide reaction that this event precipitated. They were, however, quick to seize on and intensify this aspect of space endeavor. Their superior payload capability has permitted them, safely within the confines of good scientific research, a spectacularity of achievement and a popular appeal that the U.S. has not countered effectively.

Unclassified

The recital of history up to this point brings out what are perhaps the two essential points. The U.S. lagged the USSR by at least four years in a well-organized interest in space, and by an accidental consequence of developments of a purely military nature also lagged by several years in the development of vehicles suited to advanced performance in space research. Thus the two nations entered the space age.

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IV. A BRIEF HISTORY OF THE US AND USSR SPACE PROGRAMS

Unclassified

Although in the public mind Sputnik I ushered in the era of space, actually a great deal of quiet scientific rocket activity had preceded this event. Since World War II, both the U.S. and USSR have fired many hundreds of sounding rockets and vertical probes. The majority were for upper atmosphere and solar research. In addition, the Soviets have developed a meteorological rocket for more or less routine use in weather studies. The programs of the two countries have also resulted in hundreds of research papers on the composition of the atmosphere, the ionosphere, cosmic rays, earth magnetism and solar radiation.

Unclassified

The U.S. has employed V-2's, special rockets such as the Viking and Aerobee, and the Nike-Cajun. The USSR has also used V-2's and short to intermediate range ballistic missile types. Of these the "geophysical rocket" has carried more than a ton and a half of payload to an altitude of 255 n.m.

Unclassified

A Soviet specialty in their sounding rocket program has been the recoverable capsule technique. This technique has been extensively used in bio-medical experimentation. Many dogs and other animals have been sent to "vast heights" and recovered alive in parachuted capsules.

Unclassified

The remainder of the space program to date has comprised the earth-orbiting vehicles and the space probes. Consider first the satellite program. In terms of numbers, the U.S.

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has put 15 payloads into near-earth orbit. Eight of these, were scientific satellites, in the vanguard and Explorer series. The USSR has launched only three earth orbiters. The announced purpose of all three vehicles were purely scientific.

Unclassified In addition, each nation has launched three space probes: generically the "Pioneers" in the U.S. and the "Luniks" in the USSR.

Unclassified The maximum payload for a U.S. "scientific" satellite is about 140 lbs, in the Explorer VI vehicle. In the "military" Discoverer series, the maximum net payload was about 550 lbs. In the Russian sequence of satellites, the Sputnik III payload of 2130 lbs. of scientific instrumentation was the largest. In terms of total net payload pounds in orbit, the two nations are running about neck to neck with approximately 3400 lbs. apiece. In terms of net payload for purely scientific missions, however, the Russian figure is about 3400 lbs. to about 400 lbs. for the U.S.

Unclassified The heaviest payload of the U.S. probe program was 40 lbs. (Pioneer I) as compared with the Soviet maximum of 960 lbs. (Lunik III). In terms of total payload pounds for probes, the USSR had about 2600 lbs., the U.S. about 65 lbs.

Unclassified In the course of this program the U.S. made use of 6 different vehicle types. This proliferation of vehicle types represented a rapid improvisation in the face of an unexpected demand on our technology. And, indeed, our ability to improvise

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enabled us to emerge from the sudden onslaught of Sputnik I with more dignity than might otherwise have been the case. However, to date the U.S. has been unable to make full use of its ICBM booster for space applications.

Unclassified

The number of vehicle types used in the USSR program was probably about three.

Unclassified

The vital statistics given in this section do tell a story, but they do not tell the whole story. They bespeak the hurried and somewhat frantic attempt to catch up with the Russians. They indicate clearly the greatly superior weight-lifting capacity of the Russian vehicles over those of the U.S.

Unclassified

Wherein the "vital statistics" fail to tell the whole story in that they give no clue to the quality of the scientific experiments which each of these missions represents. Neither do they suggest the very profound impact the spectacular Russian "firsts" and our sometimes apparently dismal failures have had on world opinion. The ensuing sections of the report will deal with these similar matters.

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V. A TECHNICAL EVALUATION OF US AND USSR ACHIEVEMENTS IN SPACE

Unclassified

It is necessary to be somewhat thoughtful and even philosophical in attempting a comparison of two programs of such a complex kind. In particular, it is necessary to preserve certain distinctions among the meanings of the word "achievement" -- distinctions that correspond to different facets of man's interests and qualities. It is difficult to make the word conform to clean and separate categories, but a suitable set might be defined as follows.

1) Scientific.

Unclassified

This category is self-explanatory -- science in space has already allowed man to ascertain important facts about his universe that he could have discovered in no other way.

2) Spectacular.

Unclassified

It is perhaps unfortunate to label this category "spectacular" since a certain undeserved tarnish of vulgarity attaches to the word which is improper to the present context. It was certainly not vulgarity which led world opinion to acclaim Hillary's conquest of Everest as an heroic and spectacular feat. In the same sense, it would be churlish to deny the same quality to Russia's Lunik II, simply on the basis that it deposited some fractured terrestrial hardware on the moon.

3) Developmental.

Unclassified

The developmental missions are those mainly directed toward

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making possible a more remote and ultimate aim. Thus the forthcoming 100 ft. balloon of Project ECHO, which, not in itself a communication system, will yield information indispensable to the development of such a system.

4) Serviceable.

Unclassified

The "serviceable" category includes many military missions of a long-term nature, such as early waning and reconnaissance, but also peaceful uses, of possible international benefit, such as communications satellites and meteorological and navigational satellites.

Unclassified

With these distinctions in mind, let us examine the achievements in space of each nation, and in particular list the more important "firsts" which each country has been able to contribute.

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Table 1

Principal U.S. Firsts

Unclassified

1. Detailed photo of solar ultraviolet spectrum
2. Measurement of solar X-radiation
3. Plotting of ultraviolet sources in sky
4. Complete photo of tropical storm
5. Discovery of Van Allen belt:
   a) Its geometry and zones
   b) Its character as trapped corpuscular radiation
6. The "pear-shaped" earth
7. Accurate measurement of earth's oblateness
8. Discovery of high density of upper atmosphere
9. Correlation of density fluctuations with those of solar 10 cm. radiation
10. The Argus experiment
11. Use of solar powered batteries
12. Project SCORE, as indicating feasibility of "active repeater" concept

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Table 2

Principal USSR Firsts

Unclassified

1. Routine use of a recoverable meteorological rocket
2. Routine recovery of large animals from high altitude flights
3. Artificial earth satellite
4. Orbiting of a large animal (Laika)
5. Attitude controlled space laboratory
6. Mass spectroscopy of outer atmosphere and space Confirmation
7. [illegible] of Stormer current ring about earth
8. Lunar fly-by
9. Lunar impact
10. Determination of electron concentrations near moon
11. Measurement of magnetic field of moon
12. Picture of hidden side of moon.

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Unclassified

Both of these lists are very impressive. It will be observed that most of the achievements belong to the first two categories, i.e., scientific and spectacular. A few of the achievements have a developmental flavor, e.g., solar power, Project Score and the Soviet space laboratory.

Unclassified

It is clear that the Russians excelled in those spectacular achievements that capture the public imagination. Most of these spectacular achievements represented at the same time good science (e.g., picture of the far side of the moon). In addition, the Russian vehicles were heavily instrumented to permit the simultaneous conduct of many scientific measurements, and their various space programs have furnished data for hundreds of scientific papers.

Unclassified

It is equally clear that the U.S. achievements have not been such as to capture the public imagination. However, the U.S. effort represented very good science. A detailed balance leads to the conclusion that scientific outputs of the U.S. space program were superior to those of the USSR in both quality and quantity. U.S. scientists made maximum use of the payload weights at their disposal. Indeed, items 6, 7, 11 and, to a certain extent, items 8 and 9, resulted from the Vanguard I payload of 3.25 lbs. In addition, U.S. space scientists have displayed more interest in following up the results of their discoveries by additional space flights than have those of the USSR.

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Unclassified

Besides comparing the achievements themselves, it is useful to compare the space science of the two nations field by field. Although matters of personal judgment are involved here, detailed appraisal of the scientific status of the two nations in space work has lead to the following summary of Table 3. The balance is generally fairly even but with a definite edge for the U.S. Historical differences of national scientific interests are reflected in this table. The U.S. is preeminent in solar radiation measurements, for example, and the USSR in biological experimentation supporting their long-range interest in manned exploration of space.

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Table 3

Comparison of U.S. and USSR in Various Fields of Space Science

	Field	Status
Unclassified	Geodesy	U.S. ahead
	High Energy Particle Radiations	U.S. ahead
	Solar and Stellar Radiations	U.S. ahead
	Upper Atmosphere	U.S. slightly ahead
	Aurora	U.S. slightly ahead
	Magnetic Fields	Comparable
	Meteors	Comparable
	Meteorology	Comparable
	Ionosphere	USSR slightly ahead
	Lunar Measurements	USSR ahead
	Biosciences	USSR ahead

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Unclassified

The U.S. and USSR programs have produced much basic scientific data of mutual interest. Conventions regarding exchange of such data were established with Russia, at least within the framework of the IGY. A two-way exchange has indeed gone on, but the U.S. has been the more active agent. In particular, Moscow has failed to submit catalogues of the data in its World Data Center, as agreed to under the IGY, despite U.S. compliance with its part of the bargain; and it has provided no telemetry data on U.S. satellites (in spite of repeated requests), whereas the U.S. has provided the Soviets with 46 taps of telemetered records of the three Sputniks. In addition, the U.S. has published in scientific journals both here and abroad a bairly complete and timely record of its achievements. There are other evidences that Russian candor is less complete than our own, but these are probably sufficient.

Unclassified

From a purely scientific point of view, the U.S. achievements in space look very well in comparison with those of the USSR. From a broader point of view, the political impact of these achievements cannot be overlooked in the comparison. In the political domain, the USSR space program has been outstandingly more effective than that of the U.S., and this point will be returned to in more detail further on.

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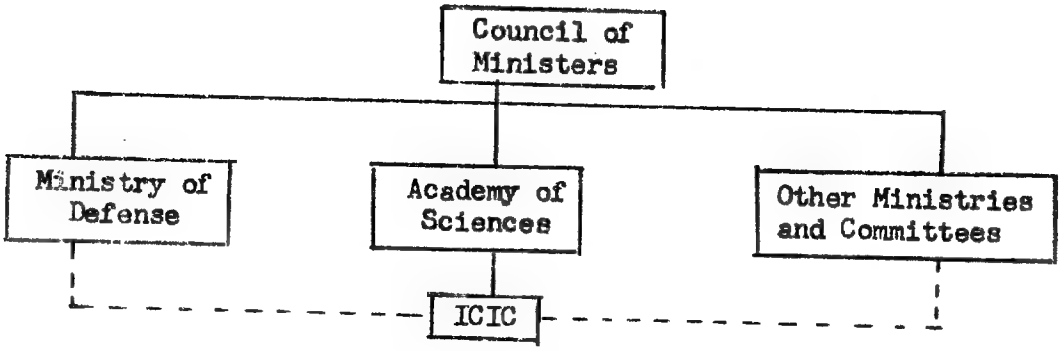
VI. COMMITMENT AND UTILIZATION OF EFFORT IN THE SPACE PROGRAMS OF THE US AND USSR

1. Organization of Effort.

Unclassified

The principal organization, whose concern with space is openly acknowledged, in the Interagency Commission for Interplanetary Communications (ICIC), which was established in late 1954, under the Academy of Sciences. It appears to plan and administer the scientific aspects of the Soviet space program, and may also be the executive unit for the scientific space program as a whole. The ICIC is composed of some of the best Soviet scientists and engineers (a few of these scientists and engineers also hold high military rank).

U. S. S.R. ORGANIZATION



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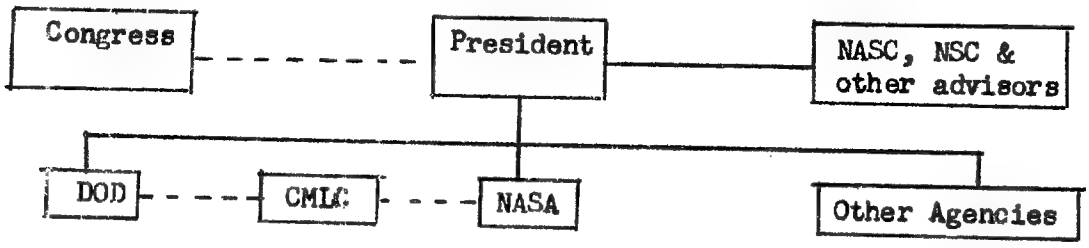
This Commission has access, as the figure indicates, to the Ministry of Defense, and other Ministries, laboratories and institutes. Altogether the USSR space organization appears to be centrally controlled, and may possess close and effective liaison with the Soviet ICBM program through the Ministry of Defense upon which it appears to defend for rocketry and launch facilities.

Unclassified

The U.S. organization is too familiar to warrant a detailed discussion. Essentially, the NASA, established in 1958, is charged with the responsibility and direction of scientific and civilian activities and the DOD with the responsibility and direction of activities peculiar to the military.

U. S. ORGANIZATION



Both NASA and DOD report directly to the President. Liaison between the two is provided by the Civilian Military Liaison Committee. The NASC, NSC and others advise the President in matters relating to space.

Unclassified

It is difficult to see wherein all the important differences in organization may lie, and to trace the effects of these differences on the space programs of the two countries.

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Certainly, the four year difference in dates is significant, and possibly the following comments on apparent organizational differences may be of some importance.

Unclassified

The ICIC has the central role in Soviet scientific space activities. It probably reports to the executive level of the government via its parent organizations, the Academy of Sciences. In the U.S., the responsibilities comparable with those of the ICIC are vested in two agencies, the NASA and DOD, each of which reports directly to the President.

2. Commitment of Scientific Resources.

Unclassified

It is difficult to derive precisely comparable figures on the marshaling of scientific talent and resources behind the space programs of the two countries. In the USSR, as indicated above, the ICIC is the central agency in space, and its centrality and power give it the ability to organize the Russian scientific effort in a unified and efficient fashion. The membership of the ICIC includes some of the USSR's most illustrious scientific talent. However, it is probable that few of them make a full-time business of space.

Unclassified

A large number of institutes and universities are active in the space sciences, and in direct support of the space program. Some 25 organizations are probably directly affiliated with the astronomical portions of this work. One of these, the Institute for Theoretical Astronomy, has a level of activity in celestial

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mechanics unmatched in any other similar organization in the world.

Unclassified

The Soviet program in life support -- aimed at implementing the USSR goal of manned space flight, is significantly more active than that of the U.S. At least 25 major research institutes are known to be involved in this program.

Unclassified

In the U.S., the top-level scientific talent concerned with space is certainly no less illustrious than that of the USSR, but it may fall somewhat short of it in concentration of effort. Some 40 or more major contracting activities and several hundred sub-contracting activities are associated in large part with the ballistic missile and space flight programs. The major government laboratories and research centers of NASA are directly concerned and several other agencies, in particular the DOD and AEC, furnish significant scientific support of the effort. The National Academy of Sciences, together with a number of universities, concern themselves with the scientific aspects of the U.S. program, mostly very much on a part-time basis.

Unclassified

While it is impossible to be very precise or quantitative on this point, it seems likely that the USSR may devote more basic scientific talent and probably devotes a larger fraction of its total scientific talent to the space effort than does the U.S.

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3. Commitment of Economic Resources

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In the intelligence analyses there are indications of Soviet advanced research and development programs paralleling many of our own. In addition, a sizable portion of the total ICBM vehicle test program appears to have been devoted to identifiable space flight objectives.

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Owing to the difficulties of obtaining information, much of the Russian iceberg of space endeavor is under water and hidden from our view. However, out of the welter of details that bear on this issue, it seems only possible to conclude that the USSR may be devoting at least as much economic resource to space as is the U.S. and is possibly devoting a much greater fraction of its total economic resources than is the U.S.

4. Political Utilization.

Unclassified

No comparision between the space activities and capabilities of the U.S. and USSR can wholly avoid the issue of the political impact that these programs have had on the public mind here and abroad. The subject is by its very nature emotionally charged, and perhaps the best that can be done is to state what facts are available and to attempt a cool sorting out of the real basic issues, and to indicate wherever possible the technical factors involved.

Unclassified

The fact can hardly be challenged that the USSR has been able to exploit its space program for its political ends far more effectively than has the U.S. Surveys show a profound change in world opinion concerning the previously assumed technological and industrial supremacy of the United States. Moreover, it seems to be in the realm of fact to assert that world opinion has tended to equate space supremacy to military supremacy.

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Unclassified The air can be cleared a bit by asserting at once that this equation is totally fallacious as of our present state of knowledge. The shortcomings of our ICBM as a booster for space vehicles is no reflection on its adequacy as a weapon, and in those areas wherein space technology abuts on military technology the U.S. technical position is strong.

Unclassified The U.S. itself appears to have accepted this equation, and the somewhat hysterical attitude that this acceptance has provided a confused and harried environment in which to try to implement a sensible and stepwise space program. However, the following facts remain:

Unclassified a) People, being emotional creatures, will continue to be impressed and swayed by space missions which possess (in addition to their more scientific attributes) a certain novelty, of an adventurous or spectacular nature. In addition, people will certainly continue in their appraisal of a nation's stature in the light of the character of that nation's space exploits. Because of the very real political and economic implications of this appraisal, it is impossible to dismiss as trivial or unimportant the attempt to intrude into a space program a leavening of popularly appealing "firsts."

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Unclassified

b) The USSR has been singularly adroit in its planning and its propagandizing of its space exploits, and they have reaped real political rewards as a result. Part of this benefit accrued through the Soviet habit of announcing publicly only those flights already successfully performed. Conversely, the U.S. habit of announcing flights in advance has caused the U.S. failures to reflect a sort of indirect credit on the Soviet Union.

Unclassified

c) The U.S. is by the simple fact of its inferior weight-lifting capacity less well placed than the USSR to capitalize on these popular appeals. It is not, however, totally helpless in this respect, as many seem to assume. A more positive point of view on this issue in the future could go far toward restoring a measure of national prestige.

Unclassified

d) Although the U.S. has not been able to capitalize on those aspects of space exploration having most popular appeal, it has taken important initiatives in promoting international cooperation in space activities, and it has derived some political advantages -- as compared with the USSR -- from this. Such activities have included our promotion of the establishment of the U. N. ad hoc Committee on Outer Space; cooperative

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projects and the exchange of technical information with the United Kingdom, Australia and Canada; and strong assistance in the form of an offer to launch an entire satellite payload to the non-governmental scientific body COSPAR.

Unclassified

e) There have been a number of technical deterrents to our ability to perform our program in space. Among these are:

(1) Lack of sufficient laboratory and component testing and an insistence to fly soonest.

(2) Lack of sufficient hardware in many of our programs.

(3) Perhaps too large a variety of different basic vehicles requiring certain duplicative efforts in engineering teams, facilities, equipment and services.

Unclassified

f) An effective and immediate way in which the U.S. can bolster its position is to emphasize missions having obviously international implications, such as communications, navigational and meteorological satellites. This permits us, in the first place, to play our technically strong suits, and, in the

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second place, is in accord with our national tradition of beneficent action.

Unclassified

In brief, it seems basically factural to state that the popular and political aspects of the space program cannot be safely dismissed as merely trivial and vulgar. A candid acceptance of their values might reveal much reveal much that the U.S. could presently do to improve its position.

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VII. COMPARISON OF THE TECHNOLOGY UNDERLYING SPACE ACTIVITIES

1. Present Rocket Engines and Structures

Confidential Little direct evidence exists that will allow a comparative discussion of the present state of U.S. and USSR development in conventional rocket engines and structures for rocket vehicles. Consistently in their natural design philosophy, however, the Soviets have not sought highly optimized systems but have used more conservative approaches when compared with American work. This philosophy is summed up in a statement attributed to the Russians, "the better is the enemy of the good." Those data which are available indicate that this philosophy was carried over into their rocket engine and vehicle designs.

Confidential The only data available on the USSR design of conventional large-thrust rocket engines indicate that at an early date (before 1950) parallel designs of a 100 metric ton (220,000 lbs) thrust motor using LOX and kerosene was initiated. If, as seems likely, the Soviets developed from this engine their basic ICBM and space vehicle engine, it might easily have a higher thrust level at the present date. The comparable engine now in use in the U.S. ICBM, Atlas type space vehicle booster, has a thrust of about 150,000 to 170,000 lbs.

Confidential Our knowledge as to Soviet vehicle design and construction is extremely limited. It is known that the Soviet designers have years of experience, backed up by a fund of tested reliable components. Analysis of photographs of Soviet missiles and an evaluation of the last stage of the Luniks supports the argument that the USSR structural

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may be based on a somewhat more conservative approach than comparable U.S. designs.

Unclassified

On the basis of the limited facts available, about all that can be said on a comparative basis is that the USSR has designed, constructed, and successfully flight-tested, rocket engines and structures of about twice the size of those developed by the United States.

2. Advanced Rocket Technology

Confidential

All available evidence suggests that the U.S. and USSR are running about even in work on advanced propulsion techniques. The USSR is apparently interested in boron fuels, in the production of UHMH and in developing a prototype liquid hydrogen plant. Sedov has said that Kapitsa is concerned with the application of nuclear energy to rocket propulsion. Ion and photon propulsion have been intelligently discussed by Soviet scientists.

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Confidential All of these indications seem to place the U.S. and the USSR in about the same place with respect to advanced and futuristic propulsion techniques. There are indications, however, that U.S. liquid hydrogen technology, and the techniques associated with the fabrication of large single-grain solid rocket engines, may be superior to those of the USSR.

3. Auxiliary Vehicle-Borne Equipment

Unclassified A central necessity for space operations is a source of electrical power in the vehicles. The Russians have, like ourselves, used chemical batteries with and without the use of solar cells. The success of the Soviet solar batteris (beginning with Sputnik III) betokens a rate of growth in the semi-conductor arts that exceed our own, in view of the fact that these arts were initiated in this country. In terms of present capabilities, however, the two nations are about equal in their capabilities for power. Both nations are studying and developing methods of directly converting atomic and heat energy into electrical energy.

Unclassified Both the U.S. and the USSR have demonstrated the ability to stabilize vehicles in space, the U.S. in its Discoverer series, the USSR in its vertical live animal flights and, notably, in Sputnik II which carried the dog and the Lunik III which photographed the moon.

Unclassified Both countries appear to understand adequately the environmental control problem for instrumented flight, and the USSR provided an environment capable of sustaining life in the dog Laika for a period in excess of one day, possibly as much as five days.

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An important benchmark of Soviet progress in these auxiliary arts is furnished by Lunik III. The complexity of the operations performed in this flight, i.e., film processing, exposure control, electronic scanning, variable read-out rate, complex programming and command control, environmental control, advanced power supply, camera stabilization and orientation is comparable in a basic sense to those functions planned for the U.S. SAMOS reconnaissance satellite to be flown in about two years. All of the these facts support the conviction that, whatever the relative positions of the two countries in these fields, the USSR is making progress at a more rapid rate than we.

4. Guidance

Unclassified

U.S. guidance technology is in an advanced state of development, but so far in the space program only its more rudimentary manifestations have been felt. This has been because a lack of weight-lifting capacity has prohibited the use abroad the later stages of U.S. vehicles of guidance packages that might otherwise have been used. Beginning in 1960, a radioinertial system will be flown, and in 1961 an all-inertial system will be flight tested.

Confidential

The Russians are believed to be using a radioinertial guidance system, at least in the Lunik series, the Soviets have stated that radio methods are employed to correct the automatic guidance devices on their satellite and lunar rockets.

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This fact, together with the time required to develop all inertial guidance leads us to believe they have not yet used such a system in their space work.

Unclassified

Altogether, it seems only possible to conclude that neither the U.S. nor the USSR are likely to be hampered in any space undertaking in the near future by a lack of adequate guidance. The U.S. has not yet been able to use its best injection guidance capability, owing to the payload limitations of its boosters. The future capabilities of the USSR are now known, but are not likely to remain static, since the basic theory and techniques that pertain to guidance are strongly developed in that country. Guidance appears to constitute approximately a stand-off.

5. Computer Technology

Confidential

The USSR has only 200 to 400 stored program digital computers, as compared to 3,000 in the U.S. The latest Soviet production machine (M 20) is comparable to the best vacuum tube machine available in this country three years ago. They are most certainly developing a fully transistorized high speed machine.

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Confidential The relative scarcity of large computers and their slight inferiority to current U.S. models seems in no way to have interfered with a satisfactory prosecution of their space effort. More than 1,000 lunar orbits were computed prior to their Lunik missions. It appears that accurate track data is piped directly into STRELA computer installations in Moscow, thus permitting a most expeditious issuance of ephemerides on new Soviet space objects.

With respect to other computer-related areas and disciplines, the following statements can be made:

Confidential

(a) The USSR is conversant with the latest ideas in computer technology, but they have made few original contributions to the art.

(b) There is no evidence in the USSR of concentrated effort on ultra-small or ultra-fast computer components.

(c) More theoretical work is done in the USSR than in the U.S. on the general class of logical problems associated with computers and computer use.

Confidential In general, U.S. computer technology is at present superior, by a lead of about 2 to 3 years, to that in the USSR. This lead, if

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maintained, is a potential source of strength to the U.S., although the Russian deficiency in this respect has so far apparently not hampered their space activities. However, in future ulta-complex missions (e.g., those involving stellar-inertial mid-course guidance), the difference might prove significant.

6. Electronics and Communications

Unclassified The general Soviet base in the electronic arts seem to be fairly broad. It includes several major institutes in the Academy of Sciences orbit, in some leading universities and in various military research laboratories.

Unclassified In the basic sciences that bear on electronics, the USSR is very well equipped. The Russians are expert in radio wave propagation theory. Their antenna designs, however, have not been characterized by any particular originality. Their theoretical work in radio astronomy is good, but their actual radio telescopes are inferior to those of the U.S.

Unclassified Their theorists are proficient in information theory and allied disciplines, though probably they are not significantly ahead of similar U.S. theorists.

Unclassified They probably have no particular edge over the U.S. in the theory of automatic control, except possibly in the field of non-linear differential equations. There is no reason to believe that U.S.

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engineering practices in this field are not as good or better than those of the USSR.

Confidential While there is some indication that the USSR has lagged the U.S. in the past in the design and development of electronic components, there are suggestions that the USSR is catching up fairly rapidly. In particular Soviet scientists are currently concerned with the development and application of the MASER and the parametric types of amplifiers, invented and first developed in the United States. Soviet work in semi-conductors, which started after our own, is now at a level of advancement equal to our own.

Confidential In radar the USSR has achieved a good, if not an outstanding capability, although there are no indications of Russian radars which could compare with advanced U.S. track sets. If Soviet deficiencies in tracking accuracy exist, they can be partially offset by good smoothing and by simple inertial back-ups, and the Russians are well-versed in these techniques.

Unclassified Soviet telemetry has been adequate, reliable and quite prodigal. Many of the USSR telemetry channels on their space vehicles have never been identified. The transmission back to earth of the moon photo argues a high competence in space communications. Miniaturization of electronic equipment is a U.S. strong point; however, the USSR is known to be advancing in this art and are currently producing such equipment.

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Its non-appearance on Soviet spacecraft has been explained by Russian scientists on a "why should we bother" basis. In U. S. space activities, on the other hand, where a severe payload limitation exists, the U.S. talent for miniaturization had to be used to offset this deficiency to a certain extent.

Unclassified While there are many indications that the USSR is advancing very rapidly in the electronics arts, it seems fair to say that the U.S. still possesses a definite lead in many of the relevant areas. On the other hand, there is no Soviet deficiency in these areas of such a nature as to impede their progress in the prosecution of their space program.

7. Payload Instrumentation

Unclassified The basic instruments used for physical experiments in the Soviet space vehicles have generally been adequate, but not outstanding, as compared to U.S. developments. The Soviets have used standard instruments in most cases, and in a few cases have copied U.S. designs. On the other hand, where the need existed, the Soviets have successfully designed the unique instruments necessary to meet their objectives; and they have shown high competence in designing complex instrumentation payloads. As explained earlier, the Soviets have not felt the need to devote great attention to the miniaturization of equipment.

Unclassified In the field of instrumentation, the relative position of the U.S. with respect to the USSR is difficult to evaluate. However, an examination of the record of achievement would tend to confirm that

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the U.S. has a clear lead. The principal factors considered in arriving at this judgment are:

(a) The superior scientific achievement of the U.S. over the USSR made with a disadvantage in individual and total scientific payload weights;

(b) The well-known extensive American activity in electronics and communication;

(c) The U.S. lead in the utilization of semi-conductors in electronics;

(d) The widespread and productive effort in the U.S. in the area of miniaturization and micro-miniaturization;

(e) The conviction that the U.S. has a definite lead in the art of assembling and producing complex electronic equipment;

(f) The broad base supplied by university and industrial participation in our programs; and

(g) The remarkable Soviet success with Lunik III in photographing the moon and relaying the results to earth.

Unclassified It is felt that the USSR may be on a par with with us in theoretical matters, on understanding the physical processes, and on understanding circuit design and use, but has not had our long and varied experience in developing a facility in the mechanical and electrical arts.

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Unclassified For these reasons, it is felt that the U.S. can put together neater, more efficient and more reliable payload packages than can the USSR.

8. Recovery Techniques

Unclassified Simple parachute recovery of instrumented payload from high-altitude sounding rockets has been practiced by both the Soviets and the U.S. for many years. However, the USSR experience in this area is much more extensive than that of the U.S. because the Soviets originally placed greater emphasis on payload recovery, as opposed to U.S. emphasis on telemetry, as a prime method of data recovery from sounding rockets.

Unclassified Recovery of payloads becomes more difficult as the re-entry velocity, and thus the aerodynamic heating, is increased. Safe recovery of payloads from ballistic missiles and orbiting space vehicles is therefore more difficult than recovery from sounding rockets. The U.S. has recovered several IRBM and ICBM nose cones using heat sink and ablation methods. Successful recovery of a monkey from an IRBM flight and recovery of an unmanned Mercury sapsule has been accomplished. The USSR may have attempted recoveries from ICBM flights.

Unclassified The U.S. is developing a system for recovery of a payload from a satellite orbit (Discoverer) using orbit stabilization, retro rockets, spin rockets, heat shields, parachutes and automatic sequencing. A somewhat similar system is also being developed for project Mercury.

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There is no information available on similar Soviet developments, nor is there any indication that the USSR has attempted to recover payloads from orbiting vehicles.

Unclassified On the basis of the available information, it appears that the USSR has more experience than the U.S. in the recovery of payloads from sounding rockets. However, the U.S. appears to have more experience than the USSR in the development and recovery of payloads under the conditions of high velocity and extremem aerodynamic heating that are characteristic of entry into the atmosphere from a satellite orbit.

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VIII. COMPARISON OF SOME OF THE PRIMARY MISSION CAPABILITIES

1. Vehicles

Unclassified The characteristics of the U.S. and USSR space vehicles are summarized in the following table.

Unclassified The space programs of both nations are based almost exclusively* on the use of ballistic missile boosters. The USSR satellites and probes have employed their ICBM boosters almost exclusively, while major U.S. reliance to date has been placed on IRBM types because of earlier availability. (The Atlas configurations are just now beginning to enter the arena in a serious way.)

Unclassified The U.S. vehicle types used to date are six in number (unless relatively minor modifications are counted). Payload capabilities vary from about 30 lbs. for the Jupiter C to about 600 lbs. for the

* A notable exception is the Vanguard first stage, which was specific to satellite use.

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Thor Agena (Discoverer series). It is worth noting that the upper stages of the Thor Able have relied on the Vanguard technology. As mentioned earlier, the large number of types, while not desirable of itself, represented the speediest response to an unexpected demand.

Unclassified The immediate generation of new vehicles is based on the Atlas booster, with upper stages based on the Vanguard and Agena technologies. These types have payload capabilities of 5,000 lbs. and will be in initial use toward the end of 1960 under the present program. This will be the earliest time the U.S. will have matched the USSR payload capability of early 1958, indicating of lag of about three years.

Unclassified Through this time period, 1960, there is nothing essentially new in upper stage motors. (The basic Agena and Vanguard engines were in existence in the era of Sputnik I.) By mid-61 the first real innovation will come in as the Centau second stage. This is a liquid hydrogen engine of markedly increased specific impulse. The Centaur will allow about 9,000 lbs. in orbit.

Confidential The first totally new vehicle will be the Saturn, which will not be fully serviceable until 1965 at the present level of effort. This schedule is not technology limited, but is set by present levels of funding and priority.

Unclassified Further advances in large vehicle design will depend upon the development of the single-chamber 1.5 million pound thrust engine. The vehicle configuration cannot be determined until the characteristics of this engine are known and possible uses of the vehicle are more firmly defined.

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Table

U. S. & USSR SPACE PROGRAM

	Vehicle	First* Flight	Launch Weight, lbs.	Launch Thrust, lbs.	No. of Stages	Payload Capability (lbs.) 300-nm orbit	Escape
	UNITED STATES						
CURRENT	Juno I	1/58	63,000	80,000	4	30	
CURRENT	Vanguard	3/58	22,000	28,000	3	50	
CURRENT	Juno II	12/58	122,000	150,000	4	100	20
CURRENT	Thor Able	10/58	112,000	155,000	3	200	25
CURRENT	Atlas B	12/58	240,000	390,000	1-1/2		
CURRENT	Thor Agena A	2/59	118,000	152,000	2	350	
FUTURE	Atlas Able	11/59	267,000	357,000	3		360
FUTURE	Scout	1/60	36,000	103,000	4	250	75
FUTURE	Thor Delta	3/60	112,000	150,000	3	500	65
FUTURE	Thor Epsilon	3/60	120,000	150,000	2	750	
FUTURE	Thor Agena B	4/60	125,000	150,000	2	1,600	400
FUTURE	Atlas Agena A	4/60	274,000	360,000		3,900	
FUTURE	Atlas Agena B	7/60	279,000	360,000	2	5,500	900
FUTURE	Atlas Centaur	5/61	295,000	395,000	2	8,800	2,200
FUTURE	Saturn	1/63	1,150,000	1,500,000	2/3/4	26,000 (2 Stage)	9,000
	USSR						
CURRENT	Sputnik I, II	10/57			2	1,100	
CURRENT	Sputnik III	55/58	500,000	750,000	2	3,000	
CURRENT	Lunik I, II, III	1/59	"	"	2	10,000	Max. est. 1,000

*The date for a reliable vehicle, with payload capability indicated in last column, will be later than this first flight date.

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Unclassified The entries of the figure indicate that we are still in a period of improvisation. It will not be until after mid-61 that the vehicle situation will reflect the orderly long-range plan.

Unclassified What about the USSR meanwhile? Although there is little direct evidence that bears on this question, a great deal of indirect evidence indicates that a large step in Soviet vehicle capability is to be expected -- possibly in the relatively near future. The Russians have a need for such an increased capability if their ultimate manned interplanetary flight goal is to be achieved. Such a need could have been foreseen at least by the time of the establishment of the ICIC, in late 1954, and the advanced design engineering talent must have then been available. Had work been begun at that time, such a development could be nearly completed by now.

Confidential A tentative comparison of future U.S. and USSR payload capabilities is given in the figure on page 51. Here the information suggests a lag of about two and a half years of the U.S. behind USSR capability. If Soviet rate of growth exceeds that shown here by the lines, the gap will slowly increase. If its rate of growth is less rapid than shown, the gap will decrease, but only very slowly.

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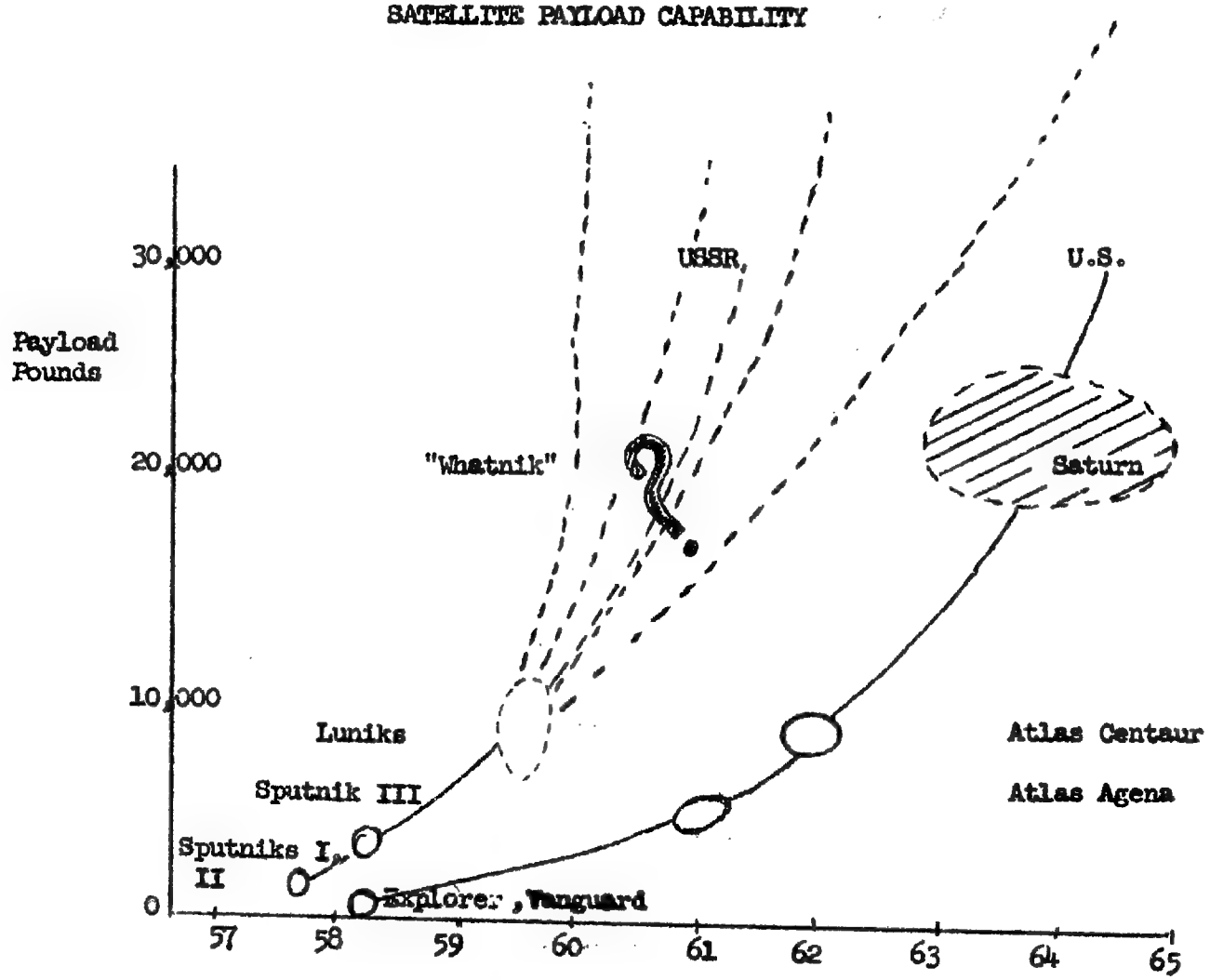
SATELLITE PAYLOAD CAPABILITY



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Unclassified 2. Ground Support Facilities

The U. S. has two major ranges well adapted to space launchings (the Atlantic and the Pacific Missile Ranges) and two further ranges (White Sands and Wallops) suited for space-associated activity.

Unclassified The USSR has two general launching areas: The Kapustin Yar, and one in the region of the Aral Sea from which space flights may have been launched. Analysis of space trajectories indicates the latter range extends northeast over Kamchatka peninsula.

Unclassified The U.S. tracking and communication net is distinguished from that of the USSR by its far-flung and global character. This is in part a natural counterpart of the global character of U.S. operations generally, in part a reflection of the dispersed system of optical and radar nets (Baker-Nunn, Minitrack) instituted for the prosecution of the IGY. Many further accretions are expanding this network, corresponding to later project (Dark Fence, Discoverer, Mercury), but the resulting plexus of networks is by no means complete, and lacks a certain desirable unity.

Unclassified Because of its somewhat decentralized and widespread character, the operation of the U.S. net is posed with singularly difficult communications problems. There is no centralized control point for all U.S. space operations (as in the case of the USSR Sputnik Headquarters) the centers varying considerably by project and by agency.

Unclassified Despite its faults, the global tracking and communication net of the U.S. both in being and planned, represented perhaps its major asset

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in space effort. It permits the tracking of U.S. space vehicles on a nearly around-the-clock basis, and it eases considerably the problems of manned orbital recovery. The U.S. network has permitted international participation in and identification with the U.S. space programs. More importantly, however, it puts the U.S. in a preferred position for carrying out missions have a character of service and of international benefit such as communication, meteorological and navigation. Such missions accord particularly well with the U.S. tradition of applied science in general, and with U.S. space objectives in particular.

Unclassified 3. Man in Space

In the bio-medical experimentation that might lead to manned flight, the Soviets have pursued a more vigorous program than our own. They have announced 22 vertical flights, carrying pairs of dogs. The U.S. has had 14, using monkeys and mice. Both nations have had their share of recoveries. The largest and most spectacular of these was the USSR flight in mid-1959, hwere, in a payload of 4,000 lbs, two dogs and a rabbit were recovered from an altitude of possibly 255 n.m.

Unclassified The general outcome of these experiments has been that, at least so far as manned recovery is concerned, the problem is more one of engineering than of medicine. Both countries are probably equally conversant with the required medical knowledge. The problem of human ecology in sustained flight is still under study in both nations. In addition, the USSR has launched the dog Laika into orbit, with suitable measuring equipment aboard.

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Unclassified Little is known of USSR intentions for early man-in-space operations beyond their expression of a determination to recover a man from orbit at an early date.

Confidential U.S. plans for man-in-space center around the Mercury project. The Mercury is a careful stepwise program which should lead to the recovery of a man from orbit in the first half of 1961. The USSR has a similar capability within the same time period or earlier, so there is a possibility - but only a possibility -- that Mercury might constitute an important U.S. first. Additional U.S. plans involve the X-15 and SynaSoar projects, and the Discoverer bio-medical capsule.

Confidential A very general but perhaps very important distinction between the U.S. and USSR man-in-space programs is a matter of national intent. The USSR has proclaimed manned exploration of space as its ultimate aim, while the U.S., despite its efforts along these lines, seems not quite clear in the degree of centrality that it assigns to this role. Such a clarification might be helpful in some fairly practical ways. For example, if a space program is geared to manned exploration as a central theme, the program is automatically assured of an adequate capability for unmanned scientific missions. The converse is not the case, however, since men weigh about 150 or so pounds and rare not readily miniaturized.

Confidential A decision on this point could have some immediate effect on U.S. plans, particularly in respect to long-lead time items such as vehicles. It is clear that for the time being the U.S. is in no position to compete

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seriously with the Russians in this area. To try to do so would be to play our game from present weakness. However, from the point of view of long-range planning, the point is an important one, and its clarification would provide us a useful tool in the appraisal of our program.

Unclassified 4. Military Applications

The only presently firmly identifiable military applications for space are concerned with "support' functions, exemplified by communications, navigation, meteorlogical and reconnaissance satellites. (All of these functions, of course, have legitimate scientific and civilian application as well, if the work "reconnaissance" is interpreted suitably boradly.)

Unclassified The Soviets have been very cautious about discussing possible military applications of satellites and they have said nothing on their military use of space. Such few references as have been noted usually take the form of non-committal Soviet comments on quoted Western suggestions.

Confidential It is relevant to observe that the geographical differences between the global character of the U.S. and the more insular structure of the USSR, make a good deal of difference in the military requirements of the two nations. Thus a satellite communications capability would benefit the U.S. far more than it would the USSR. Similarly, though for a different set of reasons, a reconnaissance satellite would have less to contribute to the USSR than to the U.S., although its usefulness for following fleet movements and troop concentrations might make it look

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attractive to the USSR. Nevertheless, the possible Soviet use of such instrumentalities cannot be altogether discounted. There is, for example, a nagging source of worry in the fact that a substantial number of the Soviets telemetry channels in their space missions have never been identified.

Unclassified

There can be no question that Soviet technical capabilities are amply adequate to permit them to develop any of the military applications that are being developed by the U.S. The stabilization, photography and sophisticated data transmission associated with the Lunik III mission leave little doubt whatever on this score.

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